Claims

1. (previously presented) A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide;

converting at least a portion of the ruthenium oxide in the layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface; and

annealing the rough-surfaced ruthenium layer in an oxidizing ambient to form passivated ruthenium in an outer portion of the rough-surfaced ruthenium layer.

2. (original) The method of claim 1 wherein the act of converting comprises heating the layer.

3. (original) The method of claim 1 wherein the act of converting comprises exposing the layer to a reducing ambient.

4. (original) The method of claim 1 wherein the act of converting comprises exposing the layer to a reduced-pressure environment.

5. (original) The method of claim 1 wherein the step of converting comprises converting at least a portion of the ruthenium oxide in the layer to ruthenium so as to produce a layer having a textured surface with a mean feature size of at least about 100 Angstroms.

6. (previously presented) A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide;

converting at least a portion of the ruthenium oxide to ruthenium by heating the layer in a reduced-pressure environment with a pressure of about 75 torr or less so as to produce a layer having a rough surface; and

annealing the portion of ruthenium oxide that is converted to ruthenium in an oxidizing ambient to form a passivated ruthenium portion.

7. (original) The method of claim 6 wherein the step of converting is performed in a reduced-pressure environment with a pressure of about 20 torr or less.

8. (original) The method of claim 6 wherein the step of converting is performed in a reduced-pressure environment with a pressure of about 5 torr or less.

9. (previously presented) A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide;

converting at least a portion of the ruthenium oxide to ruthenium by heating the layer to at least about 500°C in a reduced-pressure environment with a pressure of about 75 torr or less for a sufficient time so as to produce a layer having a rough surface; and

annealing the portion of ruthenium oxide that is converted to ruthenium in an oxidizing ambient to form a passivated ruthenium portion.

10. (original) The method of claim 9 wherein the act of converting is performed by heating the layer to at least about 750°C.

11. (original) The method of claim 9 wherein the act of converting is performed by heating the layer to at least about 800°C.

12. (original) The method of claim 9 wherein the act of converting is performed by heating the layer to at least about 500°C for at least about 2 minutes.

13. (original) The method of claim 9 wherein the act of converting is performed by heating the layer to at least about 500°C for a time in the range of about 2 to about 20 minutes.

14. (previously presented) A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide;

converting the ruthenium oxide in the layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface; and

annealing the rough-surfaced ruthenium-containing layer in an oxidizing ambient to form a passivated ruthenium portion.

15. (previously presented) A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide;

converting some ruthenium oxide in the layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface with a mean feature size of at least about 100 Angstroms; and

exposing the layer having a rough surface to an oxidizing ambient.

16-18. (canceled)

19. (previously presented) The method of claim 15 wherein the act of exposing comprises exposing the layer having a rough surface to a nitrogen-supplying reducing ambient and then to the oxidizing ambient.

20 - 29. (canceled)

30. (previously presented) A method of forming an enhanced-surface-area electrically conductive layer, the method comprising:

providing a layer containing ruthenium oxide;

selecting anneal conditions adapted to convert at least a portion of the ruthenium oxide to ruthenium;

annealing the layer under said conditions so as to produce a layer having a rough surface; and

passivating the annealed layer by exposing the annealed layer to an oxidizing ambient.

31. (canceled)

32. (original) A method of forming an enhanced-surface-area electrically conductive layer, the method comprising:

forming a layer of conducting material;

forming a layer comprising ruthenium oxide on the layer of conducting material; and

annealing the layer comprising ruthenium oxide so as to convert at least some of the ruthenium oxide to ruthenium so as to produce a layer having a textured surface with a mean feature size of about 100 Angstroms or more.

33. (original) A method of forming an enhanced-surface-area electrically conductive layer, the method comprising:

providing a layer comprising ruthenium oxide;

annealing the layer comprising ruthenium oxide so as to convert at least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a textured surface with a mean feature size of about 100 Angstroms or more; and

forming a layer of electrically conductive material conformally over the resulting layer such that the surface of the conductive material away from the resulting layer has a textured surface generally corresponding to that of the resulting layer.

34 - 40. (canceled)

41. (original) A method of forming a capacitor, the method comprising:

providing a first layer of electrically conductive material;

forming a layer containing ruthenium oxide on the layer of electrically conductive material;

annealing the layer containing ruthenium oxide so as to convert at least some of the ruthenium oxide to ruthenium and so as to produce a rough resulting surface with a mean grain size of at least about 100 Angstroms;

forming a layer of dielectric material over the layer having a rough surface; and

forming a second layer of conductive material over the layer of dielectric material.

42. (original) The method of claim 41 wherein the act of forming a layer of dielectric material comprises forming a layer of high-dielectric-constant dielectric material.

43 - 65. (canceled)

66. (original) A method of forming an array of capacitors, the method comprising:

providing a layer containing ruthenium oxide;

converting at least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a rough surface;

forming a layer of dielectric material over the resulting layer;

forming a conductive layer on the layer of dielectric material; and

defining an array of electrodes by patterning at least one of the ruthenium oxide layer or the resulting layer.

67. (original) The method of claim 66, wherein the array of electrodes is defined prior to forming the layer of dielectric material.

68. (original) The method of claim 66, wherein the array of electrodes is defined after forming the conductive layer on the dielectric layer.

69. (previously presented) The method of claim 66, wherein the array of electrodes is defined by etching.

70. (previously presented) The method of claim 66, wherein the array of electrodes is defined by chemical-mechanical polishing.

71 -73. (canceled)